AMENDMENTS TO THE CLAIMS

1. (Previously Presented) An apparatus for electrical detection of molecular interactions between immobilized probe molecules and target molecules in a sample solution, comprising:

a supporting substrate comprising an array of test sites,

a set of input electrodes, each in contact with a plurality of test sites,

a multiplexor connected to the set of input electrodes;

a set of output electrodes, each in contact with a plurality of test sites;

a demultiplexer connected to the set of output electrodes;

a conjugated polymer in contact with the test sites; and

a plurality of probe molecules immobilized to the conjugated polymer, wherein said probe molecules specifically bind to or interact with target molecules.

2. (Previously Presented) An apparatus for electrical or electrochemical detection of molecular interactions between immobilized probe molecules and target molecules in a sample solution, comprising:

a supporting substrate comprising an array of test sites,

a set of input electrodes, each in contact with a plurality of test sites;

a multiplexor connected to the set of input electrodes;

a set of output electrodes, each in contact with a plurality of test sites ;

a demultiplexor connected to the set of output electrodes;

a conjugated polymer in contact with the test sites;

a plurality of probe molecules immobilized to the conjugated polymer, wherein said probe molecules specifically bind to or interact with target molecules; and

at least one reference electrode in electrochemical contact with the input and output electrodes.

3. (Previously Presented) An apparatus according to claim 1, wherein the output electrodes and input electrodes are interdigitated at the test site.

4. (Previously Presented) An apparatus according to claim 2, wherein the output electrodes and input electrodes are interdigitated at the test site.

5. (Original) The apparatus of any of Claims 1, 2, 3, or 4, wherein the supporting substrate comprises ceramic, glass, silicon, silicon nitride, fabric, rubber, plastic, printed circuit board, compound semiconductors, or combination thereof.

Claims 6-7. (Cancelled)

8. (Original) The apparatus of any of Claims 1, 2, 3, or 4, wherein the input electrodes comprise solid or porous gold, silver, platinum, copper, titanium, chromium, or aluminum, or metal oxide, metal nitride, metal carbide, carbon, graphite, conductive plastic, metal impregnated polymers, or combinations thereof.

9. (Original) The apparatus of Claim 8, wherein the input electrodes comprise platinum.

10. (Original) The apparatus of Claim 8, wherein the input electrodes comprise gold.

11. (Original) The apparatus of any of Claims 1, 2, 3, or 4, wherein the input electrodes comprise a conductive material and an insulating material.

12. (Original) The apparatus of Claim 11, wherein the conductive material is solid or porous gold, silver, platinum, copper, titanium, chromium, or aluminum, or metal oxide, metal nitride, metal carbide, carbon, graphite, conductive plastic, metal impregnated polymers, or combinations thereof.

13. (Original) The apparatus of Claim 12, wherein the conductive material is platinum.

14. (Original) The apparatus of Claim 12, wherein the conductive material is gold.

15. (Original) The apparatus of Claim 11, wherein the insulating material is glass, silicon, plastic, rubber, fabric, ceramic, printed circuit board, or combinations thereof.

16. (Original) The apparatus of Claim 15, wherein the insulating material is silicon.

17. (Original) The apparatus of Claim 15, wherein the insulating material is glass.

18. (Original) The apparatus of Claim 11, wherein the conductive material is embedded in the supporting substrate and the supporting substrate comprises the insulating material.

19. (Cancelled)

20. (Original) The apparatus of any of Claims 1, 2, 3, or 4, wherein the output electrodes comprises solid or porous gold, silver, platinum, copper, titanium, chromium, or aluminum, or metal oxide, metal nitride, metal carbide, carbon, graphite, conductive plastic, metal impregnated polymers, or combinations thereof.

21. (Original) The apparatus of Claim 20, wherein the output electrode comprises platinum.

22. (Original) The apparatus of Claim 20, wherein the output electrode comprises gold.

23. (Original) The apparatus of any of Claims 1, 2, 3, or 4, wherein the output electrode comprises a conductive material and an insulating material.

24. (Original) The apparatus of Claim 23, wherein the conductive material is solid or porous gold, silver, platinum, copper, titanium, chromium, or aluminum, or metal oxide, metal nitride, metal carbide, carbon, graphite, conductive plastic, metal impregnated polymers, or combinations thereof.

25. (Original) The apparatus of Claim 24, wherein the conductive material is platinum.

26. (Original) The apparatus of Claim 24, wherein the conductive material is gold.

27. (Original) The apparatus of Claim 23, wherein the insulating matetial is glass, silicon, plastic, rubber, fabric, ceramic, printed circuit board, or combinations thereof.

28. (Original) The apparatus of Claim 27, wherein the insulating material is silicon.

29. (Original) The apparatus of Claim 27, wherein the insulating material is glass.

30. (Original) The apparatus of Claim 23, wherein the conductive material is embedded in the supporting substrate and the supporting substrate comprises the insulating material.

Claims 31-33. (Cancelled)

34. (Currently Amended) The apparatus of Claims 1, 2, 3, or 4, wherein the conjugated polymer is selected from the group of polymers consisting of~~comprises~~ a neutral pyrrole matrix, polypyrrole, polythiphene, polyaniline, polyfuran, polypyridine, polycarbazole, polyphenylene, poly(phenylenvinylene), polyfluorene, ~~or~~ polyindole, ~~or~~ their derivatives, and their~~or~~ copolymers.

35. (Cancelled).

36. (Cancelled)

37. (Original) The apparatus of any of Claims 1, 2, 3, or 4, wherein the probe molecules are oligonucleotides or nucleic acids.

38. (Original) The apparatus of Claim 37, wherein the probe molecules are aptamers.

39. (Original) The apparatus of any of Claims 1, 2, 3, or 4, wherein the probe molecules are proteins or peptides.

40. (Original) The apparatus of Claim 39, wherein the peptides are antibodies.

41. (Original) The apparatus of Claim 40, wherein the antibodies are a polyclonal antisera, polyclonal antibodies, or F(ab), F(ab)', F(ab)2,or Fv fragments thereof.

42. (Original) The apparatus of Claim 40, wherein the antibodies are monoclonal antibodies, or F(ab), F(ab)', F(ab)2,or Fv fragments thereof.

43. (Original) The apparatus of Claim 40, wherein the antibodies are F(ab) fragments or single chain Fv fragments produced by in vitro libraries.

44. (Currently Amended) The apparatus of any of Claims 1, 2, 3, or 4, wherein the probe molecules comprise probe molecules selected from a library selected from the group of libraries consisting of a natural products library, a phage display library, ander a combinatorial library.

45-48. (Cancelled)

49. (Original) The apparatus of either Claims 2 or 4, wherein the reference electrode comprises solid or porous gold, silver, platinum, copper, titanium, chromium, or aluminum, or metal oxide, metal nitride, metal carbide, carbon, graphite, conductive plastic, metal impregnated polymers, or combinations thereof.

50. (Original) The apparatus of Claim 49, wherein the reference electrode comprises platinum.

51. (Original) The apparatus of Claim 49, wherein the reference electrode comprises gold.

52. (Original) The apparatus of either Claims 2 or 4, wherein the conductive material is silver/silver chloride.

53. (Original) The apparatus of either Claims 2 or 4, wherein the reference electrode comprises a conductive material and an insulating material.

54. (Original) The apparatus of Claim 53, wherein the conductive material is solid or porous gold, silver, platinum, copper, titanium, chromium, or aluminum, or metal oxide, metal nitride, metal carbide, carbon, graphite, conductive plastic, metal impregnated polymers, or combinations thereof.

55. (Original) The apparatus of Claim 54, wherein the conductive material is platinum.

56. (Original) The apparatus of Claim 54, wherein the conductive material is gold.

57. (Original) The apparatus of Claim 53, wherein the insulating material is glass, silicon, plastic, rubber, fabric, ceramic, printed circuit board, or combinations thereof.

58. (Original) The apparatus of Claim 57, wherein the insulating material is silicon.

59. (Original) The apparatus of Claim 57, wherein the insulating material is glass.

60. (Original) The apparatus of Claim 53, wherein the conductive material is embedded in the supporting substrate and the supporting substrate comprises the insulating material.

61. (Previously Presented) The apparatus of any of Claims 1, 2, 3, or 4, wherein the supporting substrate further comprises a plurality of wells.

62-63. (Cancelled)

64. (Previously Presented) A method for the electrical detection of molecular interactions between a probe molecule immobilized at a specific test site and a target molecule in a sample solution, comprising:

selecting a first input electrode in contact with a plurality of test sites including said specific test site;

applying an electrical input signal to said selected input electrode ;

selecting a first output electrode in contact with a plurality of test sites including said specific test site;

detecting an output electrical signal at said selected output electrode ;

exposing the specific test site to a sample mixture containing the target molecule to form a conjugated complex, wherein said conjugated complex does not comprise a reporter group; and

detecting said target molecule based, at least in part, on said output electrical signal.

65. (Previously Presented) The method of Claim 64, wherein molecular interactions between probe molecules and target molecules are detected by using an electrical or electrochemical detection method selected from the group consisting of impedance spectroscopy, cyclic voltammetry, alternating current (AC) voltammetry, pulse voltammetry, square wave voltammetry, hydrodynamic modulation voltammetry, conductance, potential step method, potentiometric measurements, amperometric measurements, and current step method.

66. (Previously Presented) The method of Claim 64, wherein molecular interactions between probe molecules and target molecules are detected by using an electrical or electrochemical detection method that is alternating current (AC) impedance and the AC impedance is measured over a range of frequencies.

67. (Previously Presented) The method of Claim 64, wherein molecular interactions between probe molecules and target molecules are detected by using an electrical or electrochemical detection method that is alternating current (AC) impedance and the AC impedance is measured by transient methods with AC signal perturbation superimposed upon a direct current (DC) potential applied to an electrochemical cell.

68. (Previously Presented) The method of Claim 64, wherein molecular interactions between probe molecules and target molecules are detected by using an electrical or electrochemical detection method that is alternating current (AC) impedance and the AC impedance is measured by impedance analyzer, lockin amplifier, AC bridge, AC voltammetry, or combinations thereof.

69-73. (Cancelled)

74. (Previously Presented) The method of Claim 64, wherein the input electrical signal is applied using a multiplexer.

75. (Previously Presented) The method of Claim 64, wherein the output electrical signal is detected using a demultiplexer.

76 – 80. (Cancelled)